BATTLE LABS: WHAT ARE THEY, WHERE ARE THEY GOING?

John R. Wilson, Jr.

Battle Labs serve as a mechanism for assessing ideas and capabilities provided by advanced technology. More than this, however, Battle Labs represent a revolution in global thinking, testing by computer simulation, and streamlined acquisition. This paper explains what Battle Labs are and what they will be used for, now and in the future.

The Army's leadership initiated the Louisiana Maneuvers and the TRADOC Battle Labs to reshape the service for the post-Cold War era (Singley, 1993) (see Figure 1).

The Louisiana Maneuvers (LAM) are used to study battlefield capabilities and other preparedness issues using a mix of real and simulated forces. The Army leadership use the LAM to make decisions about doctrine, force mix, force composition, and other areas involving fundamental change (Ross, 1993). They are also used to evaluate the Army's ability to provide ready forces in a timely manner to meet several force-projection scenarios (Goodman, 1992). The LAM use advanced simulation technologies to enable remote units to participate in war games and test all phases of Army operations (Goodman, 1992). Advanced simulation technology is the key to the LAM's success in helping the Army leadership visualize and understand the impact of evolving equipment and doctrinal changes on battlefield performance (Ross, 1993). Simulations also avoid putting large numbers of troops in the field to train battle staffs and test new doctrine, plans, equipment, and ideas. The LAM serve as an Army process and tool, supported by TRADOC Battle Labs, and focused on warfighting modernization and policy making (Singley, 1993).

In reshaping itself into a smaller, contingency-oriented, power projection force, the Army's imperative is to maintain its technological superiority (Franks and Ross, 1993). The TRADOC Battle Labs play a part in this reshaping process and provide a means for streamlining the materiel acquisition process.

The Battle Labs serve as a mechanism for assessing ideas and capabilities evolving from advanced technology (Franks and Ross, 1993). Rather than a single place or set of resources, Battle Labs represent a harnessing of brain power committed to preparing the Army for the next war (Slear, 1992). The objective of each Battle Lab is to determine the potential military value offered by any new, 'leap-ahead' technology early in the acquisition process. The Army focuses on six specific battlefield dynamics and each is represented by a Battle Lab electronically linked to its counterparts, allowing the Army to cross any functional lines and tap into emerging technologies (Slear, 1992).

A Revolution in Thinking

The Battle Labs concept (Figure 2) is a revolution in global thinking, test by computer simulation, and streamlined acquisition (Slear, 1992). Battle Labs are a new way of doing business (Franks, 1993) and will institutionalize a new way of thinking–a 'paradigm shift'–guided by cooperation and integration (Slear, 1992). They will serve as focal points for examining the impact of the latest battlefield organization, tactics, doctrine, and technological capabilities on the battlefield of the future (Franks and Ross, 1993).

The simulation capability harnessed through the Battle Labs is evolving into virtual reality (Slear, 1992). The Battle Labs allow the Army to evaluate the battlefield performance of new technology by using simulations or prototypes (Roos, 1992). This is accomplished via a network of computer simulations connecting the six Battle Labs, known as Distributed Interactive Simulation (DIS), which serves as the foundation for the LAM exercises. These simulations generally fall into one of three categories: live, constructive, or virtual (Ross, 1993).

Live simulations include those exercises conducted by soldiers on field exercises. Constructive simulations are computerized wargaming models with the battlefield in the computer. They use programmed input to 'fight' battles on computers with models which are interactive and put soldiers in the loop to react to battlefield situations. Virtual simulations are trainers such as flight simulators or tank simulators that create a realistic synthetic environment to train and test soldiers.

Simulations from the Battle Labs represent reality in a highly believable way, whether simulating theaters of war or factories and their manufacturing processes (Franks and Ross, 1993). The DIS transmits situational awareness data to maneuver units and the Battle Labs (Franks, 1993) and creates a synthetic, virtual representation of the battlefield by connecting the separate simulations from multiple locations over the Defense Simulation

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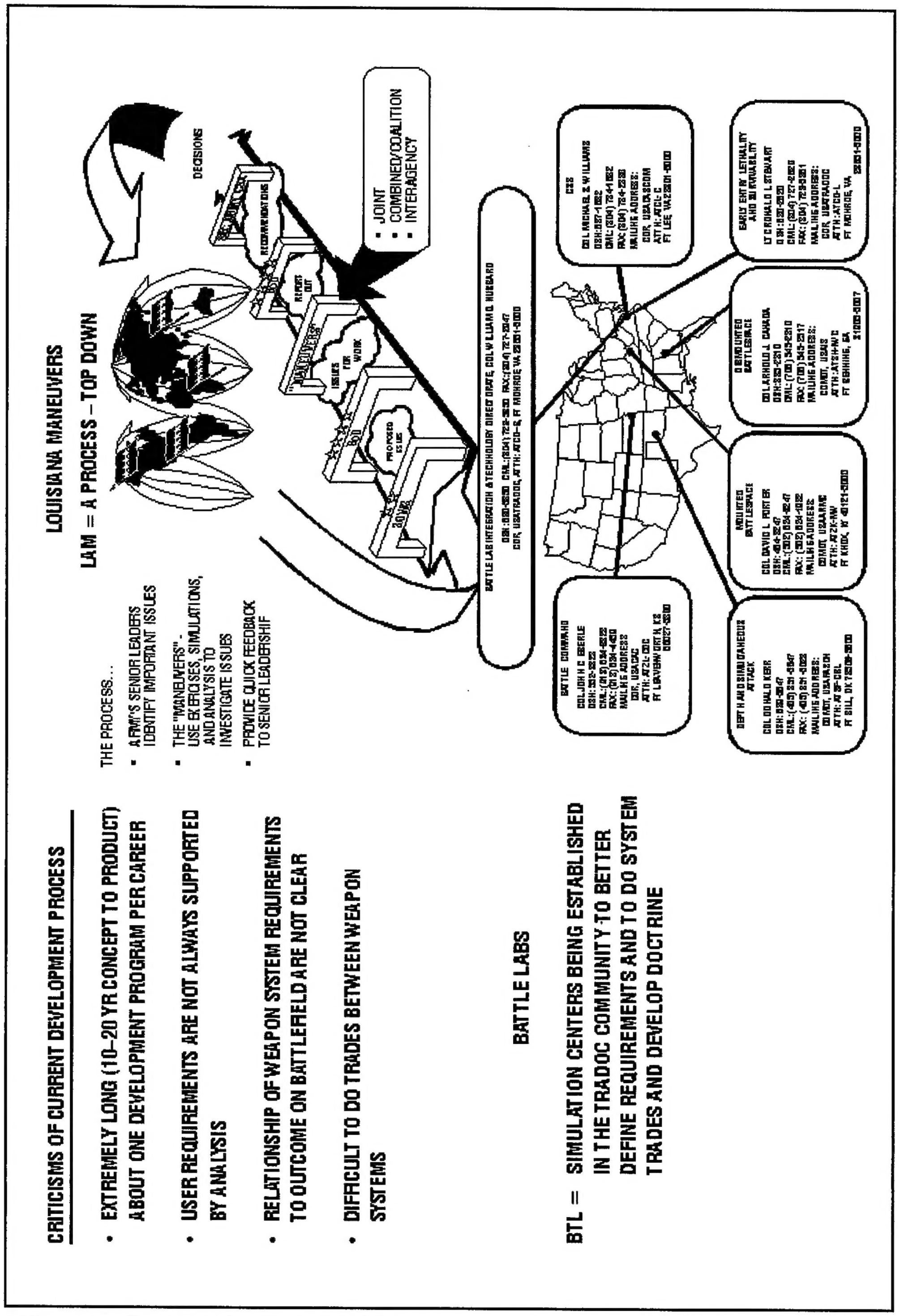

Figure 1. Battle Labs (BTL)/Louisiana Maneuvers (LAM) (Changing the Process)

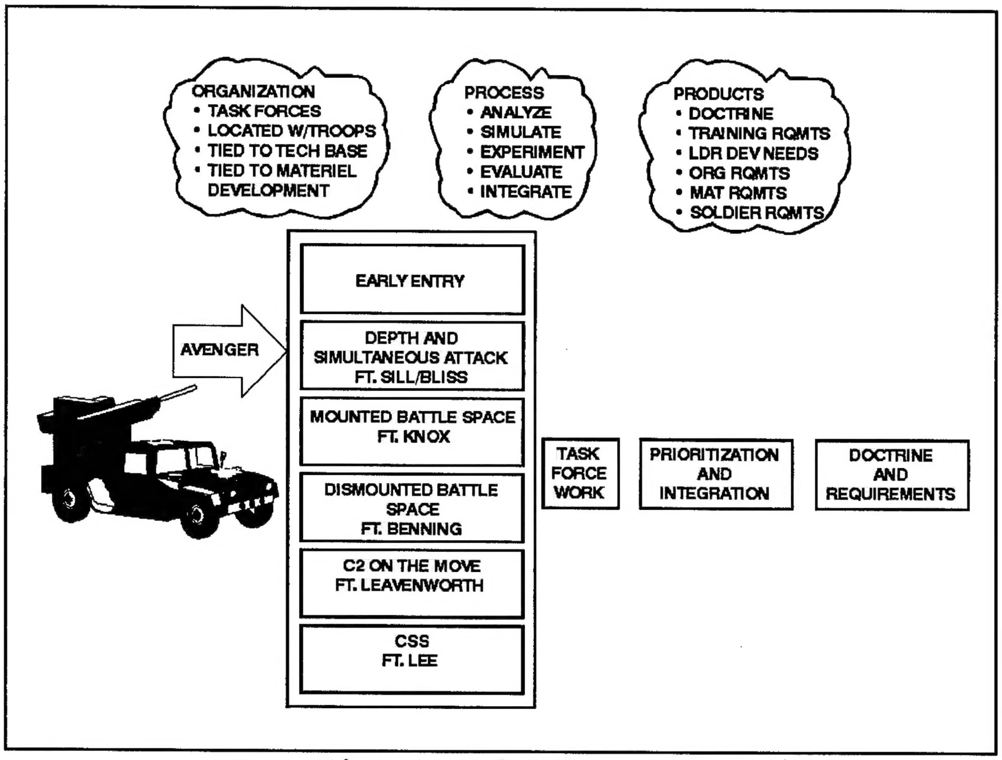

Figure 2. Battle Lab Concept

Internet (DSI). This connection of simulations forms a 'seamless integration' (Lang, 1992).

The Army uses this synthetic environment to test and evaluate the impact on overall battlefield performance of new and existing weapon systems, technology insertions into existing weapon systems, or the tactical deployment and logistical support of weapon systems (Ross, 1993). The DIS allows for the practice of warfighting skills and the evaluation of weapon system performance when cost, safety, environmental, or political constraints prohibit actual field tests and training (Ross, 1993).

As General Gordon R. Sullivan, Army Chief of Staff, recently stated:

The most promising technologies will be tested by real soldiers, first in reconfigurable crew stations, then in full-scale simulators. Final designs, production, and assembly steps are also simulated in virtual factories before actual prototypes are made. Then the actual and virtual prototypes are exercised simultaneously to discover potential problems before production begins (Binder, 1993).

Gen. Sullivan also stated:

(T)here is a great deal of frustration with the cold war acquisition system. It served us well, but it is inappro-

priate to the current threat environment, technology, and resource environments. It is very much a linear system—a system of discrete little boxes—and what we require now is a nonlinear system, a system with connectivity, not boxes. The Army must change to survive and grow. The technological possibilities are immense and could become overwhelming without a mechanism that allows us to assess the possibilities and control the pace of change. That mechanism is the Louisiana Maneuvers (Binder, 1993).

Streamlining the System

A look at the current status of our weapon systems and the acquisition process that generates them shows that we now have very complex, software-driven weapons systems, many of which still do not meet requirements after 10 years of concept definition and development. This condition was recently restated by a Department of Defense (DoD) study group investigating problems in testing (Under Secretary of Defense, 1994). The primary findings were:

1. The requirements generation and management process led to unrealistic operational requirements.

2. Program Development Testing and Evaluation (DT&E) was not sufficiently robust to confidently enter Operational Testing and Evaluation (OT&E) phase of testing.

3. System boundaries were not sufficiently defined.

Several contradictions in our current acquisition process are made apparent in the summary in Figure 3. Our weapons systems are very complex, yet we insist on low bid solutions. This can be the 'sting of death' for a program: Inexpensive but inexperienced contractors may prove unable to meet our engineering development requirements due to their lack of expertise or their underestimation of the effort necessary; alternatively, the program may amass overruns trying to overcome a more sophisticated contractor's lowball, 'buy-in' proposal.

Our acquisition system is not designed to succeed by encouraging innovative flexibility; perhaps that is why there are so few acquisition success stories in the 1990s. Another factor: rapidly changing doctrine that outpaces the acquisition processes. Is it any wonder that the Army's leadership is seeking a 'paradigm shift' when we read that soldiers are denied the improved systems they want and are forced to accept other systems they neither want nor need?

Software is the critical path of system development, and system performance depends on it. It has become the 'Achilles Heel' of weapons development (Kitfield, 1989). Figure 4 reflects the immense, rapidly increasing market cost of DoD software as compared to the relatively flat cost projections for computer hardware (Defense Systems Management College, Unk.). Why doesn't DoD control this cost? The answer is easy: DoD represents only 15 percent of the total market for software (see Figure 5) (Huskins, 1994). It is, overwhelmingly, a civilian market not amenable to regula-

- WEAPON SYSTEMS ARE COMPLEX
- DIGITAL SYSTEMS HEART OF NEW SYSTEMS
- MOST NEW SYSTEMS ARE DELIVERED LATE
- MOST NEW SYSTEMS ARE COSTLY (COST OVERRUNS)
- MOST NEW SYSTEMS HAVE PERFORMANCE SHORTFALLS
- MOST NEW SYSTEMS ARE EXPENSIVE TO MAINTAIN
- MOST NEW SYSTEMS ARE REQUIREMENT DEMANDING
- MOST PROGRAMS SUFFER FROM TIGHT BUDGETS
- LOW BID ATTEMPT TO SOLVE COMPLEX TECHNOLOGY SOFTWARE - ACHILLES HEEL OF WEAPON SYSTEMS

Figure 3. Current U.S. Systems' Status

tion by DoD.

The Army estimates that 65 percent of the money it supposedly spends on software is actually paid to define system requirements (Kitfield, 1989). The state-of-the-art technology driving these requirements at the beginning of development is often obsolete before the system is fielded (Defense Systems Management College, Unk.), a fact rarely considered in awarding contracts to a low bidder already at his technical limits. Moreover, a program manager that spends precious dollars on software tools and reusable software racks up an increased cost that may put his program at risk. This low bid mindset also ignores the peculiarities of the software market, where the product is strictly conceptual and the means to realize it are largely intellectual (Kitfield, 1989).

As support for the Battle Labs —from the grass roots as well as from the leadership—has made obvious, the need for concurrent engineering is now apparent and has started to dismantle the walls of compartmentalization. The focus on the testing and tester involvement in development is changing as shown in Figure 6 (Franks, 1993). The acceptance of testing and evaluations conducted in a virtual environment, on a synthetic battlefield, will lead to significant savings as much of the current field testing is eliminated (Ross, 1993). The realization that software, not hardware, is the driver is embodied in the Battle Lab philosophy of making engineering development and test possible earlier on (well into concept development and definition), as well as getting everybody involved through devel-

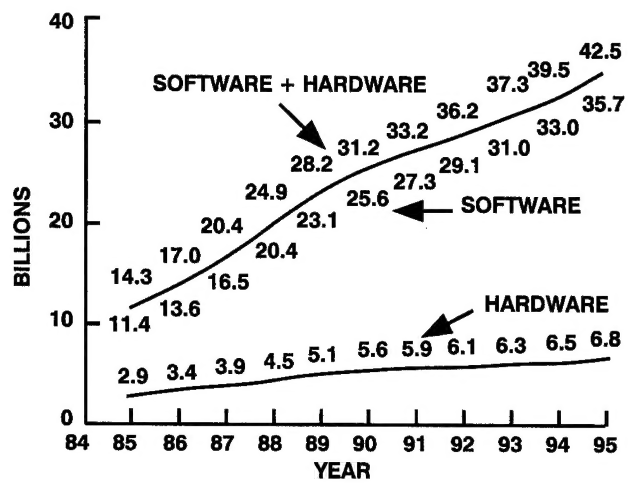

Figure 4.

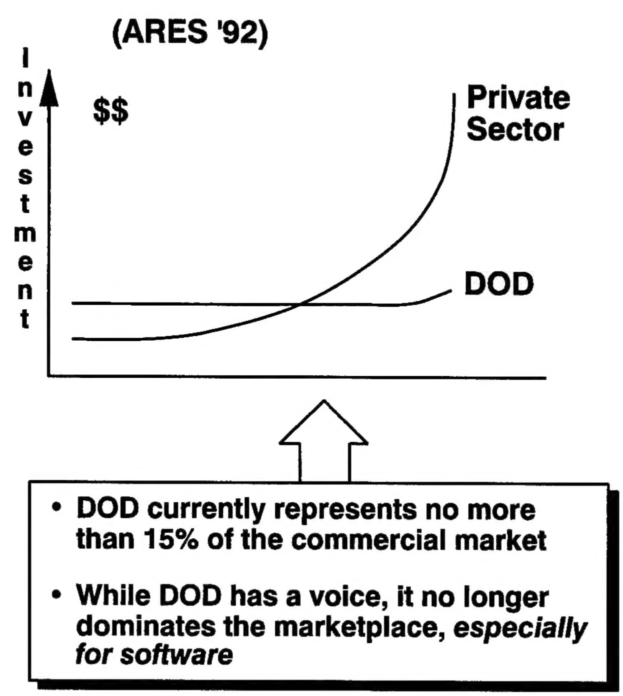

Figure 5. Relevant Trends

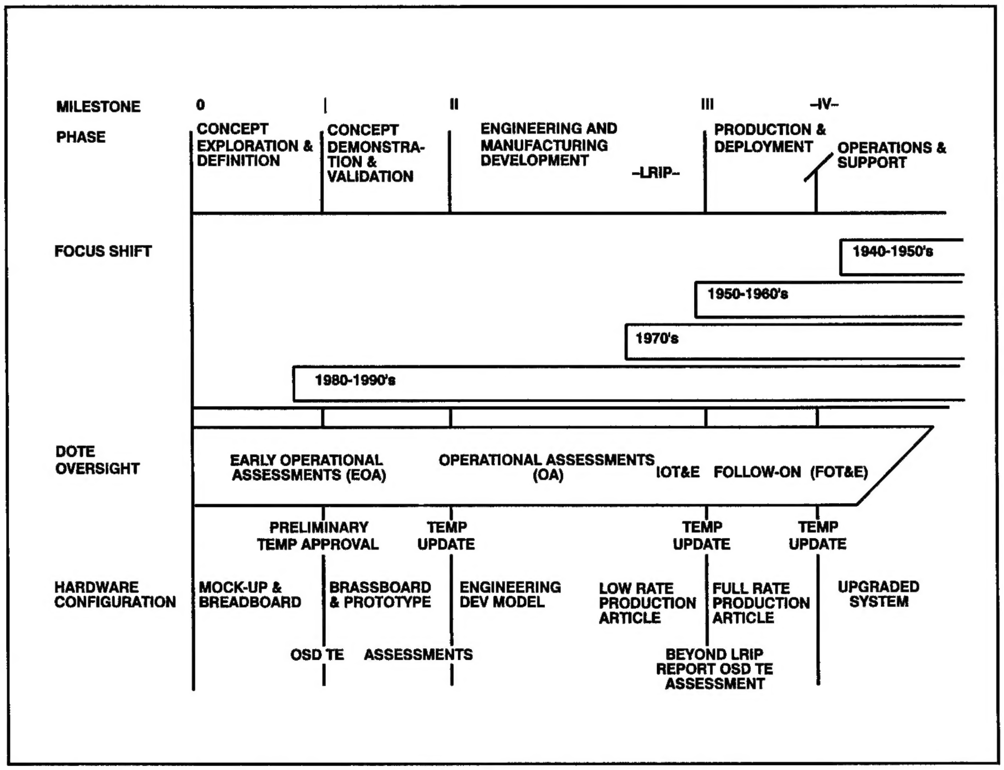

Figure 6. Changing Focus on ODT&E

opment teaming. Success in reshaping the Army requires that only the most cost-effective advanced technologies (i.e., those most likely to be found in software) are pursued to ensure a technological edge. Along with technology, the cycle time from laboratory to prototype and production must be reduced; otherwise, the advantage of developing a leading edge technology is lost (Franks and Ross, 1993). Taken together, these points reflect an understanding that early expenditures provide the greatest leverage in preventing errors. Up to 70 percent of errors are detected early, when error correction is cheapest (MaCabe and Schulmeyer, 1987).

Typically, almost 90 percent of a weapon system's cost is decided before entering development (Figure A of Figure 7); it would be a mistake wait for errors in the decision-making process to appear in the costly operational test, production, and deployment phases (Singley, 1993). We are, nevertheless, failing to detect errors before making decisions affecting what will amount to 60 percent of the costs for our weapon systems throughout their life cycles (Figure C of Figure 7).

As Gen. Sullivan has stated:

> (T)he new focus is that we are pushing armor, infantry, the entire combined arms team into the digitized world where most weapon improve-

ments are through software revisions. While the core of the 20th century land warfare is the tank, the core of the 21st century is the computer. Simulations are used to maintain readiness in a military force in which downsiz-ing and tight budgets are prime considerations for the foreseeable future (Binder, 1993).

The way is identified and the pressures are great (Figure 8). What is needed are the 'paradigm pioneers' to lay the road.

The use of Battle Labs is a needed change to keep pace in this rapidly developing information age, but to succeed it will require visionary leadership as well as good management skills. Albeit with growing pains, Battle Labs are here to stay.

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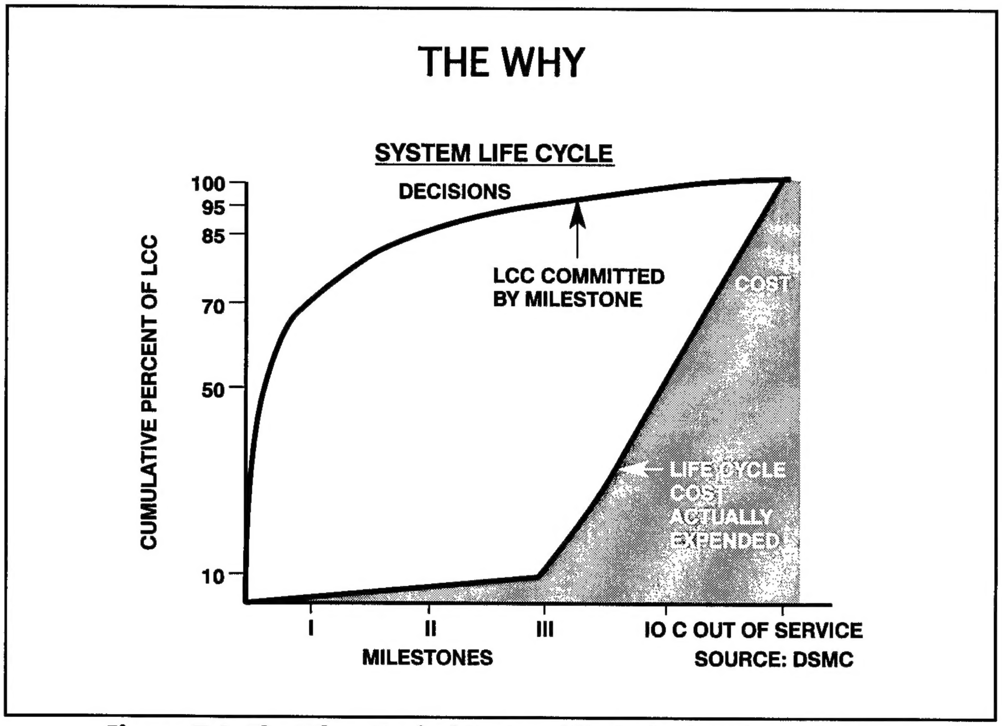

Figure 7-A. The Why - Typical System Life Cycle Cost Commitment

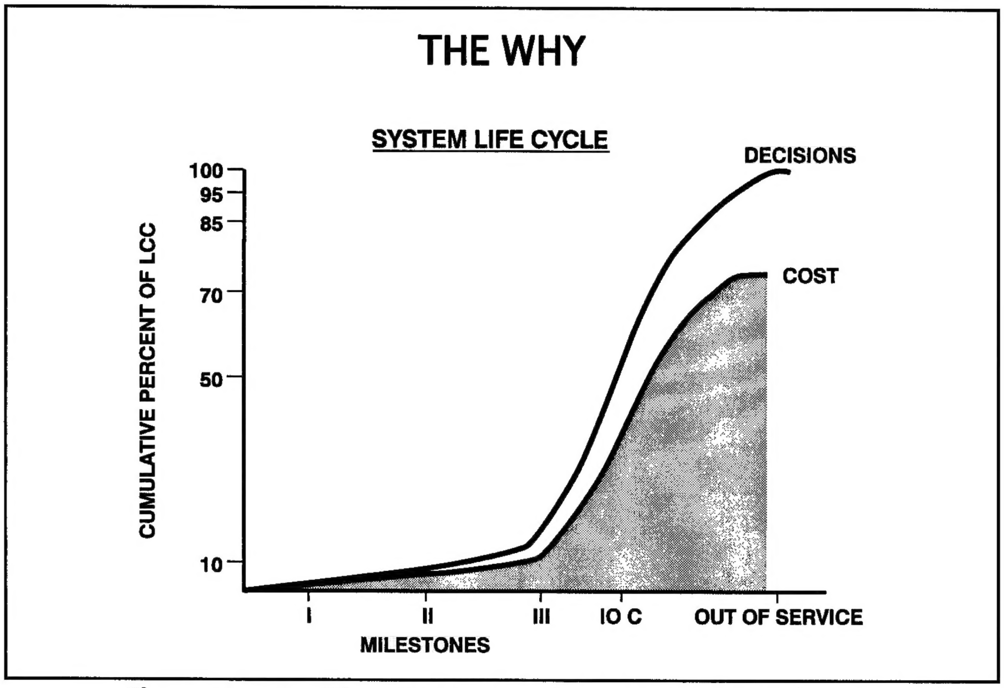

Figure 7-B. The Why - NDI System Life Cycle Cost Commitment

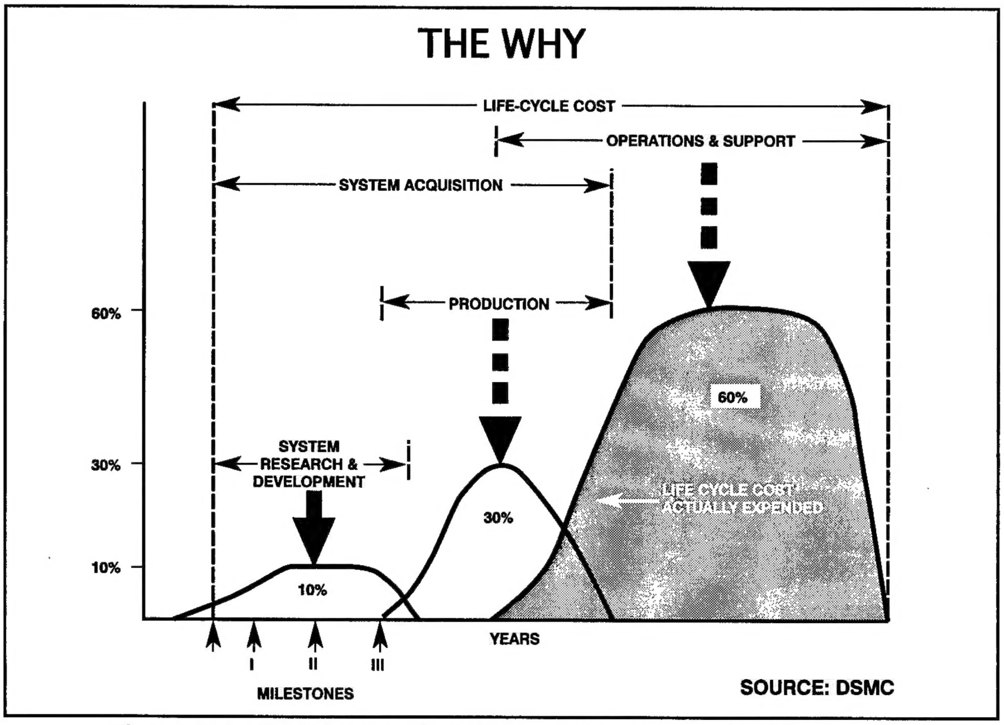

Figure 7-C. The Why - Typical System Life Cycle Cost Distribution

- EVOLUTIONARY DEVELOPMENT
  - MODULAR HARDWARE AND SOFTWARE
  - INTEGRATED FUNCTIONS
  - TIME SHARING
  - "HOLISTIC" SYSTEM DEVELOPMENT
- JOINT SERVICE HOLISTIC SYSTEM STANDARDS AND SPECIFICATIONS
- COMMERCIAL SPECIFICATIONS AND STANDARDS
- INDUSTRIAL CULTURAL CHANGE
- GOVERNMENT CULTURE CHANGE
- TECHNOLOGY LEVERAGING

EXAMPLE

IMPLEMENTING GUIDELINES
• CONCURRENT ENGINEERING • MAXIMIZE MODULARITY • EVOLUTIONARY DEVELOPMENT (PHASED DEVELOPMENT) • INCREMENTAL DEVELOPMENT (BLOCK CONFIGURATION)

Figure 8. Paradigm Pressures

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